**TruePosition**®

Location Accuracy - The Case for a Hybrid Approach

Ex Parte Presentation
Federal Communications Commission
PS Docket 07-114
June 7, 2011

# Summary

- 911 calls from Indoor areas should not be ignored

- Carriers are migrating to AGPS with AFLT or RTT but this will not be adequate to address these areas

- Technology exists today (UTDOA) that can complement AGPS to provide high Accuracy and Yield in nearly all environments

- Accuracy rules and testing guidelines (OET-71) must specify indoor accuracy requirements in order to reflect real world calling patterns

**A Hybrid approach provides the most reliable location solution for current and NextGen E911**

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD

# Indoor 911 calls should not be ignored

- States report (Alabama, Texas, Virginia, Washington, Massachusetts, Delaware, and Michigan) that percentage of wireless calls range from 52% to 72% of all calls received by PSAPs

- J.D. Power 2009 study shows that 52% of all wireless calls are made indoors

- Verizon states the percentage of indoor wireless 911 calls (20%) is lower than indoor wireless call overall. [*Ex Parte Letter of Robert Morse, Esquire on behalf of Verizon and Verizon Wireless,  PS Docket No. 07-114 (July 23, 2010)*]

- Even if we consider this lower estimate of 20%, that implies more than **2 million indoor wireless 911 calls each month**; this is more than **all** wireless 911 calls when E-911 Phase II rules were originally initiated.

# AGPS/AFLT or AGPS/RTT is not Sufficient

- "Despite the success of GPS for accurately locating most wireless E911 calls, the basic attributes of the technology are unchanged from 2007,... Obstacles to the device "seeing" a sufficient number of GPS satellites include: multipath delays when radio transmissions reflect off buildings; the limited search window, in seconds, for acquiring satellite signals; weak signal strength or penetration of GPS signals in challenged environments (GPS satellite transmissions operating at 1.5 GHz are low power and do not penetrate structures well); and inherent difficulties posed by calls placed from indoor locations because the most advanced GPS techniques only provide an extra six to ten feet of penetration within a building."

  - *Comments of Verizon and Verizon Wireless at pages 4-5, PS Docket 07-114 (January 19, 2010).*

# AGPS/AFLT or AGPS/RTT is not Sufficient

- "Sprint Nextel maintains that there are numerous factors that impact GPS technology including line-of-site limitations, multi-pathing, in-building coverage, and weather. In order to mitigate some of these factors, Sprint Nextel's CDMA solution also relies on AFLT. There are also inherent limitations to AFLT technology, however, including cell site coverage, multi-pathing, and CDMA power control."
    - *Comments of Sprint Nextel at page 5, PS Docket 07-114 (January 19, 2011)*

- "With Americans growing reliance on wireless services, there is a significant and growing need for accurate outdoor and indoor location capability. <span style="color:red">An increasing concern is that a large percentage of wireless 911 calls from the public are made indoors where GPS satellite signals are not reliable</span>, causing significant risk that the location of 911 callers and public safety personnel will not be available to a large portion of the population and public safety personnel at any given time. We note favorable technology trends and emerging approaches which hold the promise of significant improvements in location accuracy and availability."
    - *Joint Comments of the International Associations of Chiefs of Police, International Association of Fire Chiefs and the National Sheriffs' Association, PS Docket 10-55 (February 28, 2011)*

# PSAP Testing in Frisco and Austin, TX

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD

# Test Methodology

- Goal:  Test real world accuracy of U-TDOA and A-GPS

- Parameters:
  - Indoor and outdoor test points
  - Off-the-shelf phones
  - Three air interfaces
  - Three location technologies.
    - U-TDOA on GSM
    - A-GPS/AFLT on CDMA
    - A-GPS/RTT on UMTS

- Real world testing conducted in two PSAP areas of Texas
  - <u>Frisco</u>:  Suburban
  - <u>Austin</u>:  Urban, campus (U of Texas)

# Test Methodology

- Over 3500 real 911 calls made to local PSAP
  - At least ten calls from each test point
  - At least three iterations of calls at each test point

- Test point selection
  - Both indoor and outdoor test points
  - Chosen test points around city provide reasonable representation of subscriber use
  - Ground truth determined prior to test execution

- Daily export of PSAP database allowed post-processing to determine error of each test call at each point
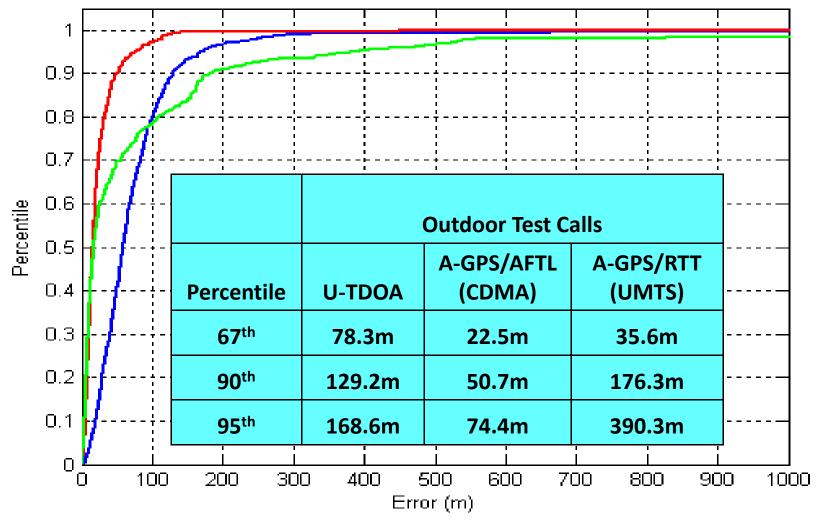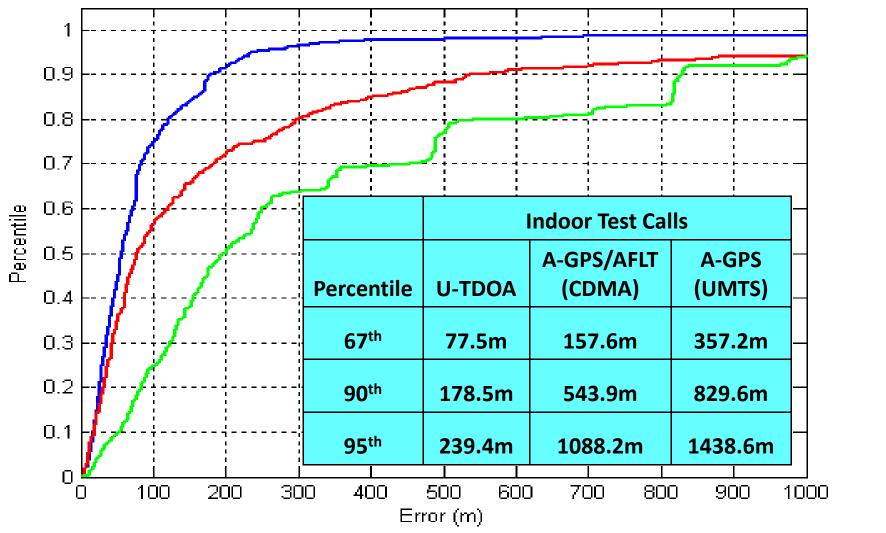
# Accuracy Results Analysis

# Results – Outdoor Calls



Texas PSAPs - Outdoor Calls [Blue-UTDOA; Red-AGPS/AFLT(CDMA); Green-AGPS(UMTS)]

| | Outdoor Test Calls | | |
|---|---|---|---|
| **Percentile** | **U-TDOA** | **A-GPS/AFTL (CDMA)** | **A-GPS/RTT (UMTS)** |
| **67th** | **78.3m** | **22.5m** | **35.6m** |
| **90th** | **129.2m** | **50.7m** | **176.3m** |
| **95th** | **168.6m** | **74.4m** | **390.3m** |

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD

# Results – Indoor Calls



Texas PSAPs - Indoor Calls [Blue-UTDOA; Red-AGPS/AFLT(CDMA); Green-AGPS(UMTS)]

| | Indoor Test Calls | | |
|---|---|---|---|
| Percentile | U-TDOA | A-GPS/AFLT (CDMA) | A-GPS (UMTS) |
| 67th | 77.5m | 157.6m | 357.2m |
| 90th | 178.5m | 543.9m | 829.6m |
| 95th | 239.4m | 1088.2m | 1438.6m |

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD
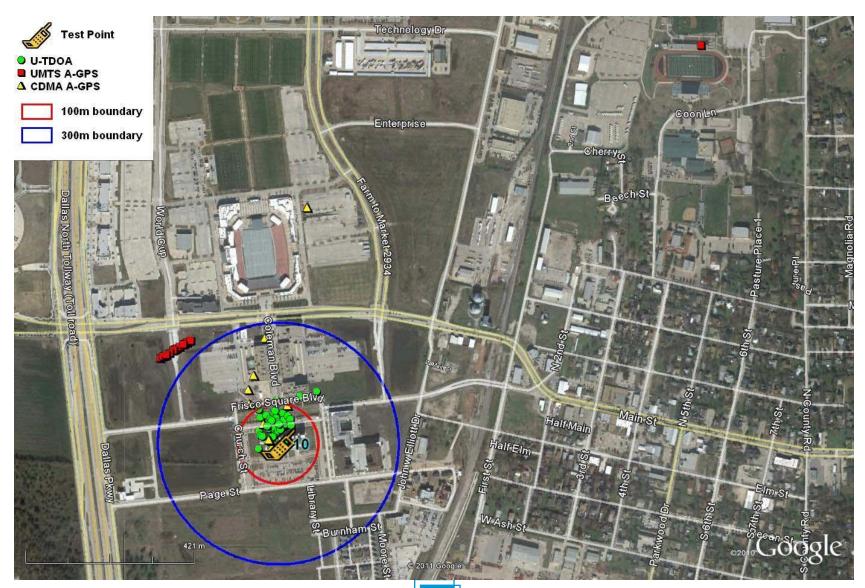
# Example Result 1 – Fire House (Indoor)

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD

# Example Results 2 – City Hall (Indoor)

PIONEERING LOCATION SOLUTIONS FOR A SAFER WORLD

# Accuracy Results Analysis

- A-GPS performs well in outdoor environments with adequate line-of-sight to satellites.

- U-TDOA work well outdoors and maintains its accuracy in indoor environments, as well as dense urban areas.

- Combining A-GPS in unobstructed environments with the complementary high accuracy of U-TDOA in urban and suburban indoor environments will provide "best of both worlds" solution.

Hybrid solution creates an improved location solution with enhanced accuracy and yield.

# Hybrid Technology Exists Today

- **Hybrid Options**

  - **Fallback**
    - A-GPS is selected as primary location method; if A-GPS fails to deliver a result, the existing U-TDOA network is used to provide accurate fallback
    - Can be implemented today with very minor changes to SMLC
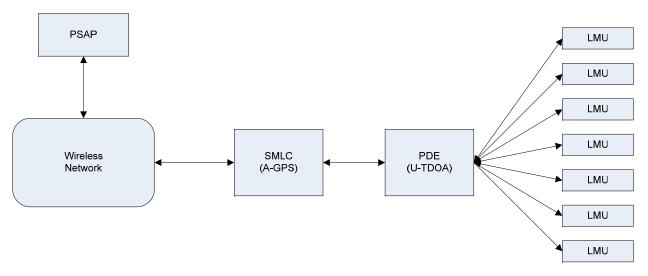
  - **Selection**
    - U-TDOA and A-GPS locations are performed simultaneously
    - SMLC returns the result with smaller uncertainty estimate
    - Can be implemented today with minor changes to SMLC and possibly BSC/RNC

# Hybrid Deployment

- **Carriers with existing Network-based location infrastructure**
  - U-TDOA equipment already deployed in network
  - AGPS capable handsets being aggressively rolled out



  - SMLC currently chooses to EITHER perform an A-GPS location OR request a U-TDOA location from the PDE

  - Relatively minor change in SMLC logic to perform BOTH an A-GPS location AND request a U-TDOA location from the PDE is all that is needed to realize the benefits of a Hybrid solution

# Hybrid Deployment

- **Carriers without existing Network-based location infrastructure**

  - A-GPS handsets already deployed

  - Investment in U-TDOA equipment would be required to realize the benefits of a Hybrid solution
    - Similar to investments already made by some nationwide carriers

  - Software changes would be required in the SMLC to request a U-TDOA location from the PDE

# Summary

- 911 calls from Indoor areas should not be ignored

- Carriers are migrating to AGPS with AFLT or RTT but this will not be adequate to address these areas

- Technology exists today (UTDOA) that can complement AGPS to provide high Accuracy and Yield in nearly all environments

- Accuracy rules and testing guidelines (OET-71) must specify indoor accuracy requirements in order to reflect real world calling patterns

**A Hybrid approach provides the most reliable location solution for current and NextGen E911**